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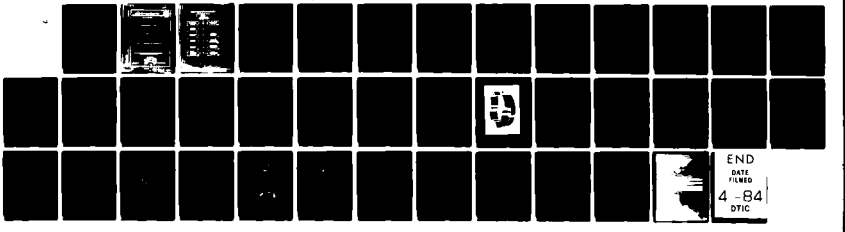

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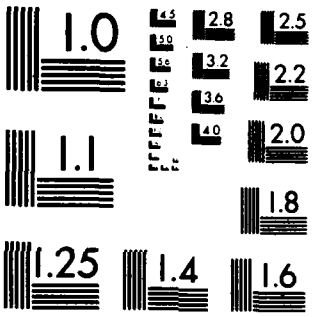

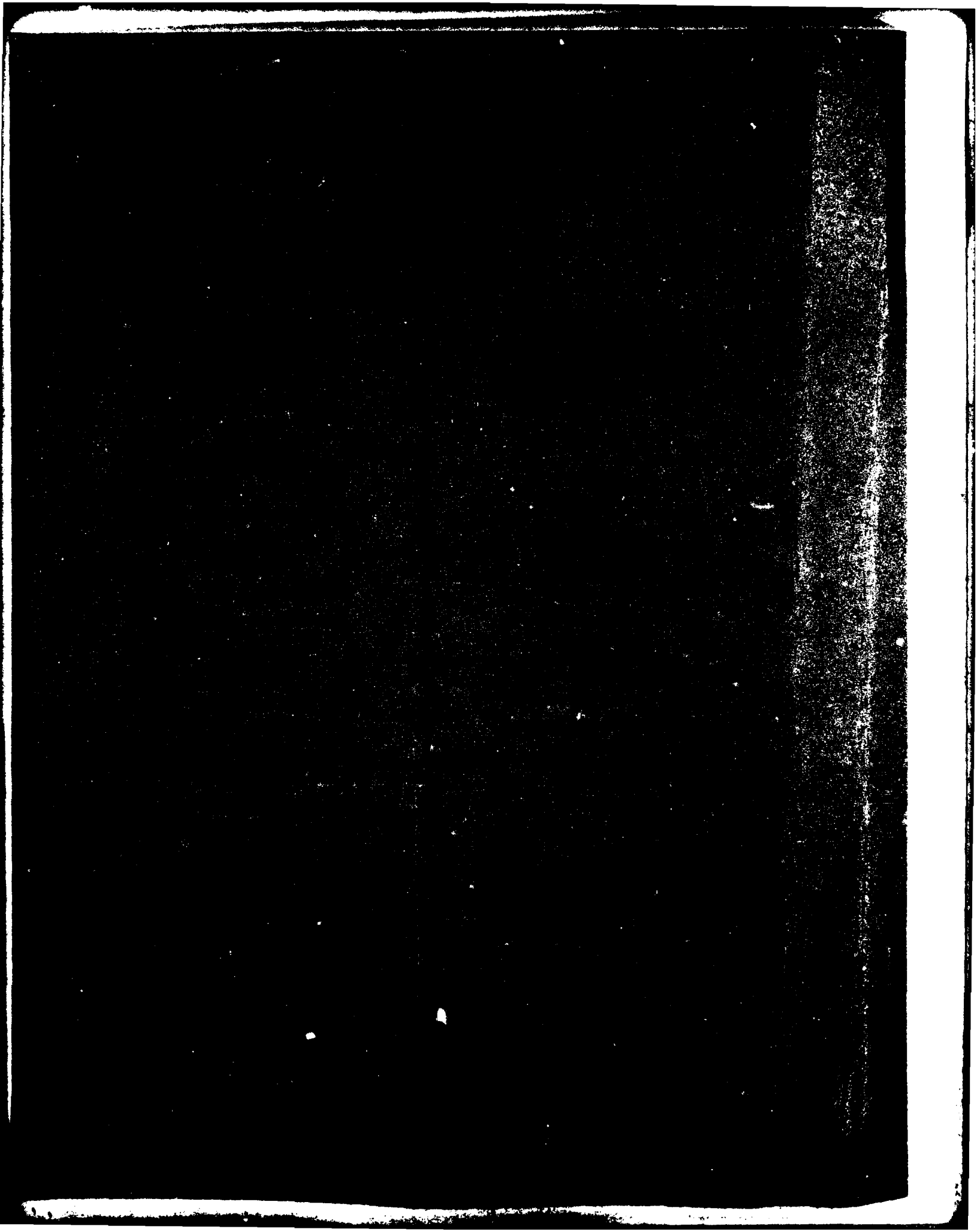

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MOVIE.BYU is an interactive graphics package of FORTRAN programs capable of displaying three-dimensional mathematical, topological, or architectural models as line drawings or as continuous tone-shaded color images. MOVIE.BYU was developed at Brigham Young University and has been installed at the David Taylor Naval Ship R&D Center on the CDC computers as part of a project to evaluate several interactive graphics programs.

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Several modifications were made by the author to MOVIE.BYU including the creation of batch versions of two of the programs. Additional examples and explanations of MOVIE.BYU capabilities are included in this report to supplement the MOVIE.BYU Training Manual. A photo album of Polaroid pictures has been assembled to show MOVIE.BYU's capabilities for continuous tone-shaded color images.

An interactive procedure was developed to automate the conversion of a NASTRAN bulk data deck to a MOVIE.BYU-readable file.

MOVIE.BYU can have many applications at DTNSRDC. Color slides, viewgraphs, or pictures for briefings, presentations, or reports can be produced from any information that MOVIE.BYU can display. Some examples are titling information, geometric models of naval structures, or stresses in a submarine hull. MOVIE.BYU can also be used to produce color movies of dynamic phenomena such as the frequency response of a structure or the fluid flow around a submerged body. MOVIE.BYU's capabilities for color images will allow a better presentation of information than any line drawing could provide.

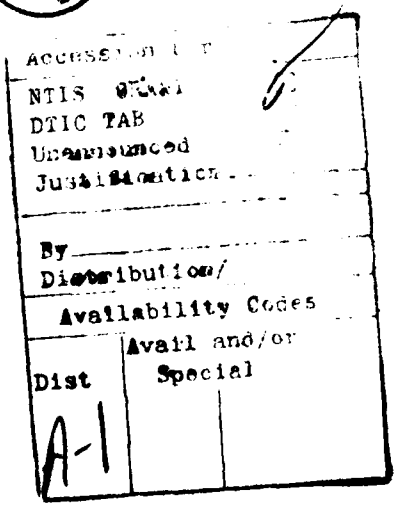

TABLE OF CONTENTS

LIST OF FIGURES

ABSTRACT

MOVIE.BYU is an interactive graphics package of FORTRAN programs capable of displaying three-dimensional mathematical, topological, or architectural models as line drawings or as continuous tone-shaded color images. MOVIE.BYU was developed at Brigham Young University and has been installed at the David Taylor Naval Ship R&D Center on the CDC computers as part of a project to evaluate several interactive graphics programs.

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ADMINISTRATIVE INFORMATION

This work was performed under Task Area SF-43-400-391, Work Unit 1720-010 at the David Taylor Naval Ship R&D Center (DTNSRDC) during FY82. The interactive automation and integration of various procedures were performed under the project Interdisciplinary Engineering Analysis System for Ships (IDEAS), Program Element 62766N, FY84 Task Area ZF66412001, and Work Unit 1844-141

INTRODUCTION

MOVIE.BYU, developed at Brigham Young University, is an interactive graphics package of Fortran programs capable of displaying three-dimensional mathematical,

topological, or architectural models as line drawings or as continuous tone-shaded color images. The models are represented by geometry, displacement, and scalar function files. A finite element analysis is a typical source of the data required for these files, but any format can be displayed.

The seven programs of MOVIE.BYU can generate titles or geometric model files; modify existing data files; and convert contour definitions into polygonal element mosaics. The resulting data files can then be displayed as line drawings or as continuous tone-shaded color images at a Tektronix terminal.

The June 1981 edition (Version 4.1) of MOVIE.BYU has been installed at DTNSRDC on the CDC computers as part of a continuing project to evaluate interactive graphics modeling and display programs.[1*] Several modifications were made to the programs to make them compatible with the Fortran 4 compiler and NOS/BE operating system used on the CDC computers. Almost all the modifications are transparent to the user.

This guide is intended to supplement the information found in the MOVIE.BYU Training Manual,[2] which contains user's manuals for all the programs, examples of most of MOVIE.BYU's capabilities, and an explanation of the mathematics used to create, manipulate, and display data files.

The reader must be familiar with the terminology and concepts used in the MOVIE.BYU User's Manual before reading this report. The User's Manual is Appendix A of the MOVIE.BYU Training Manual.[2] Copies of the User's Manual can be printed by the computer at a high speed line printer. (See page 4) The User's Manual contains explanations of the commands used in all of the MOVIE.BYU programs. These commands will be referred to throughout this report.

Because of the high cost of reproducing publication quality color pictures, examples of MOVIE.BYU's capabilities for drawing color images have not been included in the Training Manual or in this guide. However, a photo album of Polaroid pictures has been assembled to show examples of MOVIE.BYU's capabilities for drawing color images. Only one copy of the photo album exists and it may be borrowed from the author. The color pictures (frames) are referred to in this report.

---

*A complete listing of references is given on page 29.

MOVIE.BYU can be linked with other graphics programs at DTNSRDC. In particular, for display purposes MOVIE.BYU provides a powerful complement to the GPRIME geometric modeling system.[3] GPRIME provides a detailed geometric representation of a structure from which it generates 2D and 3D finite element models. Displaying a model with MOVIE.BYU uses GPRIME's output file of NASTRAN nodes and elements which must be post-processed with the conversion program (page 27). GPRIME has a hidden line removal capability for the geometry, but does not have this capability for the finite element model generator. MOVIE.BYU's hidden line removal features for GPRIME models are of great benefit to an engineer in viewing a structure. Additionally, the color capability provides help to the engineer in evaluating GPRIME-produced finite element models.

INSTALLED CAPABILITY

Five of the seven programs of MOVIE.BYU have been installed at DTNSRDC: DISPLAY, SECTION, UTILITY, TITLE, and COMPOSE. The programs UPDATE and MOSAIC have not been installed; UPDATE is required only if a previous version of MOVIE.BYU has already been installed, and MOSAIC is of limited usefulness. At DTNSRDC, the DISPLAY program has been renamed MOVIE.

All the programs of MOVIE.BYU are interactive programs. MOVIE and SECTION can also be run as batch jobs. The output from the batch version of MOVIE (a line drawing or color image) can be interactively displayed at a Tektronix terminal.

RUNNING MOVIE.BYU INTERACTIVELY

TERMINALS, BAUD RATE, AND HARD COPY

MOVIE can be run on Tektronix 4014, 4015, 4054, or 4027 terminals. The 4014, 4015, and 4054 terminals can draw a high resolution line drawing. A 4027 terminal can draw a color image or a low resolution line drawing. SECTION, TITLE, and UTILITY can be run at either Tektronix terminals or any other type of terminal.

Terminal initialization, computer dial-up, and login procedures are standard for most terminals. These procedures are outlined in the Computer Center Reference Manual (CCRM).[4] Any CDC Cyber computer can be used.

The initialization procedure for a Tektronix 4027 is not described in the CCRM. To set the baud rate of a Tektronix 4027, enter !BAU 300 or !BAU 1200. If the characters being typed do not appear on the screen, enter !ECH L. If the cursor is always at the bottom three or four lines of the screen, enter !WOR 0.

A 300- or 1200-baud rate can be used for any MOVIE.BYU program at any terminal. However, a 1200-baud rate is strongly recommended when color images are to be displayed at a Tektronix 4027 terminal, because the most time-consuming aspect of drawing color images is sending the instructions from the host computer to the terminal.

Hardcopy of a line drawing can be made directly only from a Tektronix 4014 terminal. There is no hardcopy unit for the Tektronix 4027 terminal. To get a hard copy of a color image, a camera can be used. The pictures in the photo album were taken with either a Polaroid 450 camera with a close-up lens or a Polaroid SX-70 camera.

PRINTING THE USER'S MANUAL

To obtain a hard copy of the MOVIE.BYU User's Manual, enter the following sequence of commands:

```
MSACCES,password
REQUEST,MOVIMAN,*Q
MSFETCH,MOVIMAN,ID=CARL
ROUTE,MOVIMAN,DC=PR,TID=C,FID=XXXX,FC=1T
```

where

password = MSS password for the user's computer account (usually the same as the ID unless it has been changed).

XXXX = user's computer ID

This will print the User's Manual at the central site on a high-speed line printer on narrow paper.

ACCESSING AND EXECUTING THE PROGRAMS

All the programs of MOVIE.BYU are stored on the Mass Storage System (MSS). To access any of the programs, enter the following sequence of commands interactively:

```
MSACCES,password
MSFETCH,program,ID=CARL
ETL 500
SCREEN 80
```

where

password = MSS password for the user's comput account (usually the same as the ID unles: has been changed)

program = MOVIE, SECTION, UTILITY, TITLE, or COMPOSE, depending on the program desired

When SECTION is to be run, also enter EFL 110000. If more than one program is to be accessed, only the MSFETCH command must be repeated.

Any geometry, displacement, or scalar function files to be read by any of the programs must be attached before the program is executed. Similarly, if a file is written by any program and needs to be stored, the file must be cataloged after the program is executed. There is no limit on the number of files the program can read or write. All files are rewound before every read or write.

To execute any program, enter the name of that program. The name of the program is the same name used to MSFETCH the program. All the programs begin by printing a short title and then prompt the user for a response to a question. Figures 1 and 2 illustrate the interactive use of MOVIE. An explanation of the commands used can be found in the MOVIE.BYU User's Manual.

The amount of free storage available in MOVIE and SECTION is limited. If this limit is exceeded, the batch versions of MOVIE and SECTION can be used.

```
NSRDC CY74 INTERCOM V 4.7
DATE  07/07/82
TIME  10.40.17.
LOGIN,CADRGGEN,SUP
■■■■■■■■■■ ENTER ACCESS NUMBER-
COMMAND- MSACCES,CADR
COMMAND- MSFETCH,MOVIE,ID=CARL
          743 PRUS XFERED FROM CPLR.
COMMAND- ETL 500
COMMAND- SCREEN 80
COMMAND- ATTACH,G1,TSMALLCUBEGEOM,ID=CARL
 AT CY= 002 SN=SYSSET1
COMMAND- MOVIE
<MOVIE SYSTEM DISPLAY>
<READ GEOM FILE>G1
<READ:     1 PARTS;     8 COORDINATES;     6 ELEMENTS.>
<READ DISP FILE>
<READ FUNC FILE>
<PREVIOUS RANGE:>
<     0.000 <X<      1.000     0.000 <Y<      1.000    -1.000 <Z<      0.000>
<ORIGIN MOVED TO:       .500      .500     -.500>
<DISTANCE TO ORIGIN:    3.50 ,ANGLE: 28.00 ,ZMIN:     .10 ,ZMAX:    7.00>
< 1 PARTS WITH ELEMENT LIMITS:>
   1   6

>>FAST ROTA DRAW
<MIXED DATA?>
<POOR MAN'S PROCEDURE?>Y
<PARTS I1/I2 IMMUNE TO POOR MAN'S PROCEDURE>
>>>
<PARTS I1/I2 WITH CLOCKWISE ORDERING>
>>>
<AXIS, ANGLE>Y -30 X 30
```

Figure 1 - MOVIE Executed Interactively, Input

```
>>EXIT
   EXIT
     105400   FINAL EXECUTION FL.
      0.545 CP SECONDS EXECUTION TIME.
COMMAND- LOGOUT
CPA        1.308 SEC
SS         2.359 SEC
EST. SYSTEM COST  $      .23
EST. CONNECT COST $     0.33
CONNECT TIME     0 HRS.     4 MIN.
 07/07/82  LOGGED OUT AT 10.44.50.
       <
```

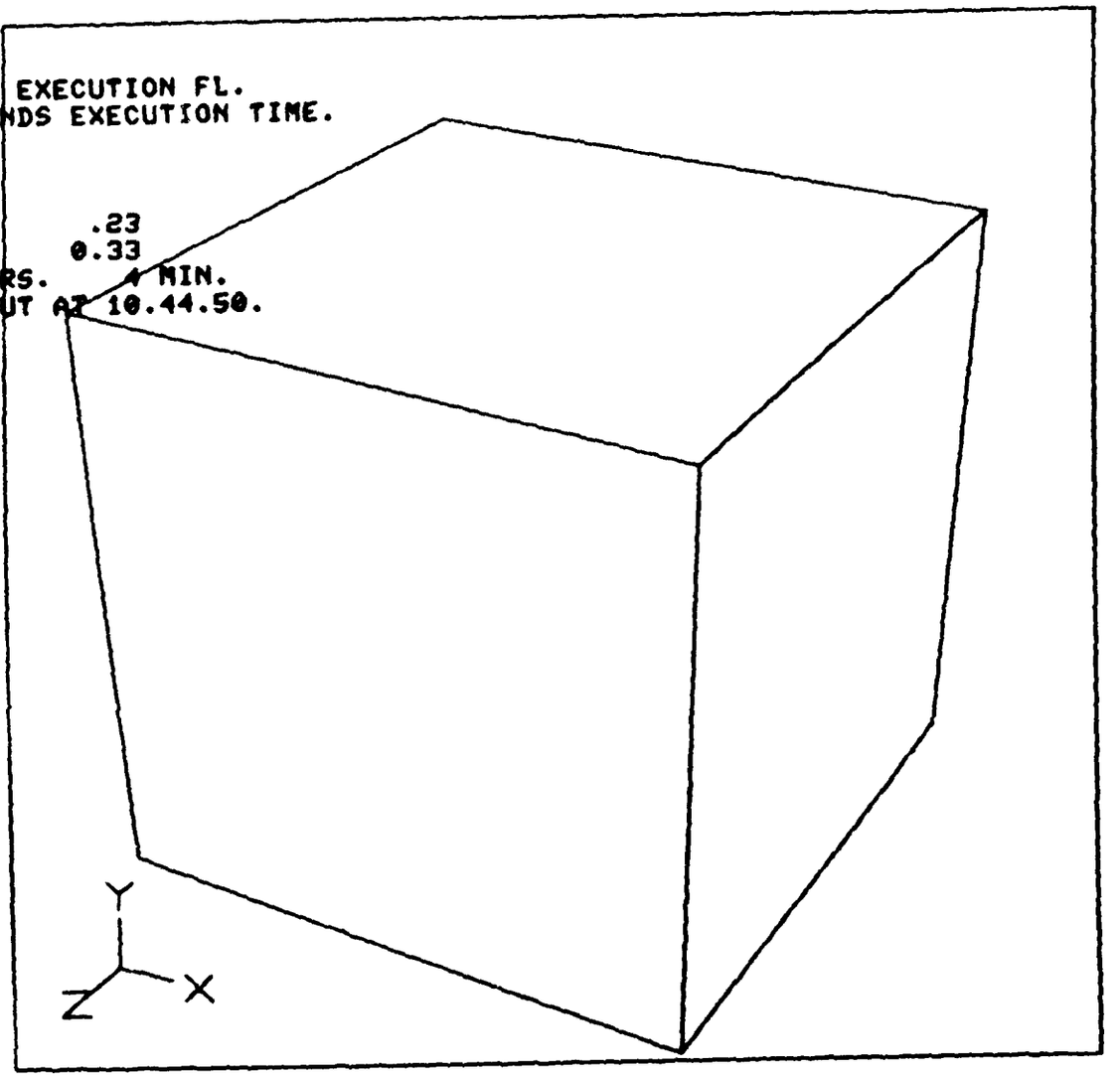

Figure 2 - MOVIE Executed Interactively, Output

BATCH VERSIONS OF MOVIE AND SECTION

The batch versions of MOVIE and SECTION are called BOVIE and BECTION, respectively. They allow a user to perform computations that exceed free storage space during the execution of MOVIE or SECTION, or to increase the number of nodes and elements available in MOVIE.

The job control cards required to run BOVIE or BECTION are similar to the commands used to run MOVIE or SECTION interactively. Any geometry, displacement, or scalar function file that will be read by either program must be attached. Any data file that is written by a program and needs to be stored must be requested and cataloged. To input commands and responses to BOVIE and BECTION, a file of all desired commands and responses must be created. The commands and responses in the file must be exactly the same and in the same order as when the job is run interactively. The only exception is when a null response for reading or writing a file is specified. If no file is desired, the word BLANK must be used.

BOVIE

Line Drawings

The RECORD option (Ref. 2, Appendix A, page 2-19) must be used to create a line drawing when BOVIE is executed. The resulting output file of the line drawing can then be displayed with COMPOSE.

The following job control cards illustrate the use of BOVIE to create a line drawing:

```
XXXX,CM300000,T100.
Charge card.
REQUEST,lfn1,*PF.
ATTACH,lfn2,geomfile,ID=XXXX.
ATTACH,lfn3,inputfile,ID=XXXX.
MSACCES,password.
MSFETCH,BOVIE,ID=CARL.
RFL,300000.
BOVIE,lfn3.
CATALOG,lfn1,outputfile,ID=XXXX.
```

where

XXXX	=	user's computer ID
password	=	MSS password
geomfile	=	permanent file name (PFN) of a geometry data file
inputfile	=	PFN of file of MOVIE commands
outputfile	=	PFN of file generated by BOVIE and to be displayed by COMPOSE
lfn1	=	local file name (LFN) of outputfile
lfn2	=	LFN of geomfile
lfn3	=	LFN of inputfile

The time on the job card can be increased or decreased as necessary. As part of the inputfile (lfn3) of MOVIE commands, lfn1 and lfn2 must appear along with LFN's of any other data files that BOVIE will read or write. The following inputfile for a line drawing will produce the same results as Figure 2:

```
G1
BLANK
BLANK
FAST ROTA
N
Y
(2 blank lines)
Y -30 X 30
RECO DRAW
OUTP
EXIT
```

G1 is lfn2 and OUTP is lfn1. The cataloged outputfile can now be displayed with COMPOSE.

Color Images

The RECORD option cannot be used to save a color image. However, if a file of the color graphics instructions necessary to draw the color image is saved, the color image can be displayed interactively.

The following job control cards illustrate batch job used to create a color image with BOVIE:

```
XXXX,CM300000,T100.
Charge card.
REQUEST,TAPE6,*PF.
ATTACH,lfn2,geomfile,ID=XXXX.
ATTACH,lfn3,inputfile,ID=XXXX.
MSACCES,password.
MSFETCH,BOVIE,ID=CARL.
RFL,300000.
BOVIE,lfn3,TAPE6.
CATALOG,TAPE6,outputfile,ID=XXXX.
```

where outputfile is the PFN of the file generated by BOVIE that will be displayed with NETED. As part of the inputfile (lfn3) of MOVIE commands, lfn2 must appear along with LFN's of any other data files that BOVIE will read or write. The following inputfile for a color image will produce the cube in Figure 2 with a white background and an orange cube.

```
G1
BLANK
BLANK
SCOP FAST ROTA COLO LIGH VIEW
TK27
C
9
462
N
N
Y
```

```
(2 blank lines)
Y -30 X 30
1 1 1
1 1 1 0 .5
(1 blank line)
Y
N
Y
1 1 1
(1 blank line)
1 1 1 6
(1 blank line)
EXIT
```

G1 is lfn2. The SCOPE, COLOR, and LIGHT commands (Ref. 2, Appendix A, pages 2-20,-6,-15) must be used when creating a color image.

To draw the color image interactively, enter the following sequence of commands at a Tektronix 4027 terminal:

```
CONNECT,OUTPUT
ATTACH,outputfile,ID=XXXX
COPYSF,outputfile,OUTPUT
```

BECTION

BECTION requires no special commands or files to produce the desired output. The following job control cards illustrate a batch job with BECTION.

```
XXXX,CM300000.
Charge card.
REQUEST,lfn1,*PF.
ATTACH,lfn2,geomfile,ID=XXXX.
ATTACH,lfn3,inputfile,ID=XXXX.
```

```
MSACCES,password.
MSFETCH,BECTION,ID=CARL.
RFL,300000.
BECTION,lfn3.
CATALOG,lfn1,outputfile,ID=XXXX.
```

As part of the inputfile (lfn3) of SECTION responses, lfn1 and lfn2 must appear along with LFN's of any other data files the BECTION will read or write. The following inputfile for BECTION will pass a clipping place through an object.

```
G1
1 1 0 0 0 1 1 1
(1 blank line)
BLANK
(1 blank line)
G2
(2 blank lines)
BLANK
```

G1 is lfn2 and G2 is lfn1.

SUPPLEMENT TO MOVIE.BYU USER'S MANUAL

GENERAL

MOVIE.BYU requests a file name by printing either <READ XXXX FILE> or <WRITE XXXX FILE> where XXXX is the type of file. To respond, enter the local file name of the desired file or enter at least one blank space if there is no file to read or write. All files are rewound before reading or writing.

To skip a question, at least one blank space must be entered. If a blank response is entered, the program interprets it to be a zero or NO. If a response has trailing zeros, such as 2 4 1 0 0, the response can be shortened to 2 4 1.

The arrays in all the programs except BOVIE have been dimensioned to allow 410 nodes, 410 elements, and 20 parts. In BOVIE the arrays have been dimensioned

to allow 1550 nodes and 1550 elements. These values may be increased in the future.

The default baud rate has been changed to 1200 for all the programs.

MOVIE and BOVIE

This section gives additional explanation of the commands for MOVIE and BOVIE and assumes the reader is familiar with the terminology and concepts used in the MOVIE.BYU Training Manual.

COLOR

Color definition in MOVIE is based on a unit cube in red, blue, green (RBG) color space (Figure 3). Any color can be specified by entering the intensities of the red, blue, and green color components. For example orange, which is halfway between red and yellow, can be specified as (1, 0, .5). Most high resolution color graphics terminals used to draw continuous tone-shaded color images have a capability of drawing between 256 and 16.7 million different colors. For most, if not all applications, this is enough colors to produce a realistic color image of any object. However, at DTNSRDC the Tektronix 4027 color graphics terminal is a low resolution terminal capable of drawing only 8 colors. These eight colors are black, white, red, green, blue, cyan, magenta, and yellow. These colors are the corners of the unit cube in RBG color space (Figure 3). Examples of the eight colors drawn by a 4027 terminal are shown in Frames 1-12 and 65-67.

To simulate colors other than the eight colors a 4027 terminal can draw, MOVIE generates patterns of two different colored dots (or pixels). For example, orange can be simulated by mixing equal amounts of red and yellow pixels. A dark shade of red will mix red and black pixels (Frame 68). Shades of gray will mix varying amounts of black and white pixels (Figure 4).

In the same manner that the 4027 terminal has only eight colors available with which to draw, MOVIE can only generate a limited number of patterns. The number of patterns available depends on the color order specified with the SCOPE command. Frames 1, 2, 3, 7, 14, and 15 illustrate color orders 3, 5, and 9. More patterns are available with the higher color orders, but even with the

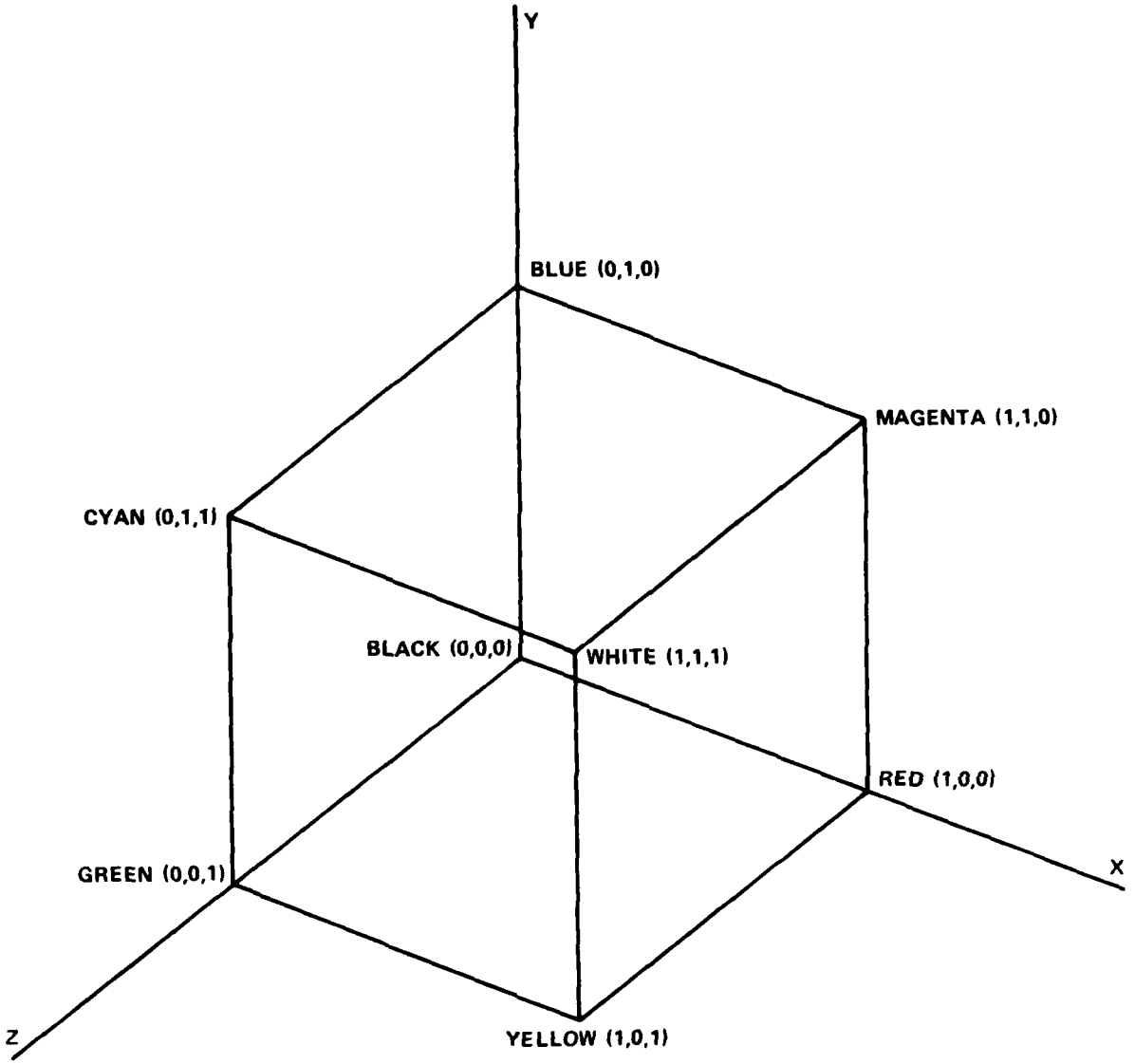

Figure 3 - RBG Color Space

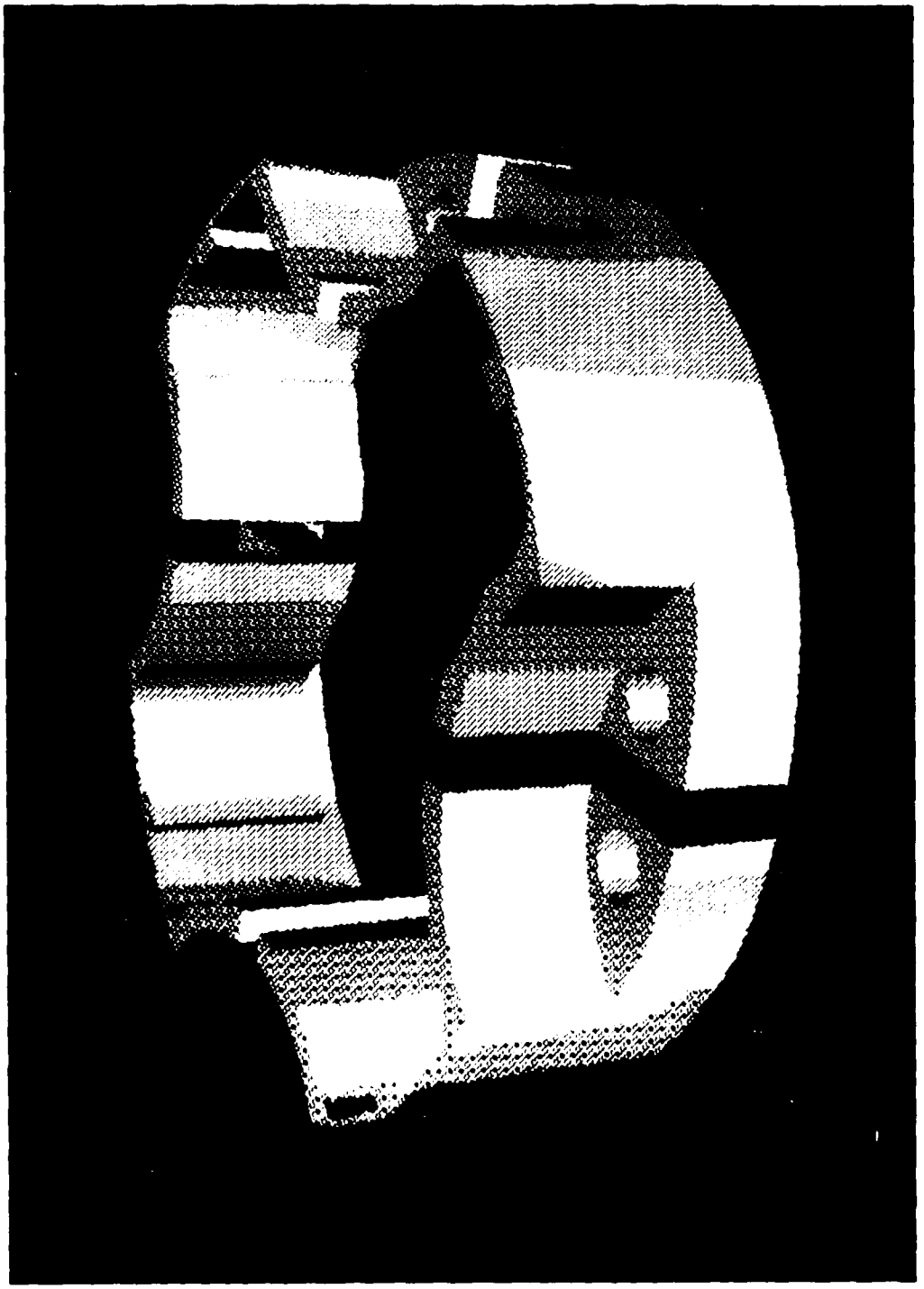

Figure 4 - Part of Projectile Housing

highest color order (9), the patterns are distinct and a boundary between two adjacent patterns can be seen. (Figure 4, Frames 4, 5, 16, 23, and 68).

Sometimes MOVIE will not generate the expected color when specifying the red, blue, and green color intensities of an object. For example, Frame 24 is a sphere made up of eight pie-shaped sections. The light source is at the eye of the observer so that the center of the sphere is lighter than the outer edges. Starting from the 3 o'clock position and moving counter-clockwise, the colors of the first three sections were specified as red (RBG color intensities of (1, 0, 0)), orange (1, 0, .5), and yellow (1, 0, 1). Patterns used in the red and yellow section make these sections appear lighter at the center of the sphere and darker at the outer edges, as it should. However the patterns generated in the orange section do not make that section appear as continuous shades of orange. Frames 23, 25, and 28-31 shown spheres with varying numbers of sections in which the RBG color intensities were specified such that the patterning used does not create the problem described in Frame 24 (also Frames 26 and 27).

CONTOUR

The position of contour lines on the face of any polygonal element will change with the orientation of that element. Compare Figure 5 and Figure 6. Figure 6 shows the same cube and contour line definitions as Figure 5 but rotated 45 degrees. The change in contour line position is due to the contouring algorithm used in MOVIE, and depends on the orientation of the object. At best the contour lines drawn by MOVIE are only approximate. The accuracy of the contour lines will increase as the finite element mesh becomes finer for a given problem.

DISTANCE

An object being displayed with the VIEW command might be clipped against the Z clipping planes if the distance to the origin is too large or too small relative to the planes. Clipping does not take place when the DRAW command is used for a line drawing.

DRAW

The messages <MAXFRE = XXXXX> and <FREE USED = XXXXX> are meaningless with the DRAW command for line drawings. The DRAW command never uses any FREE storage. These messages are useful only when the VIEW command is used.

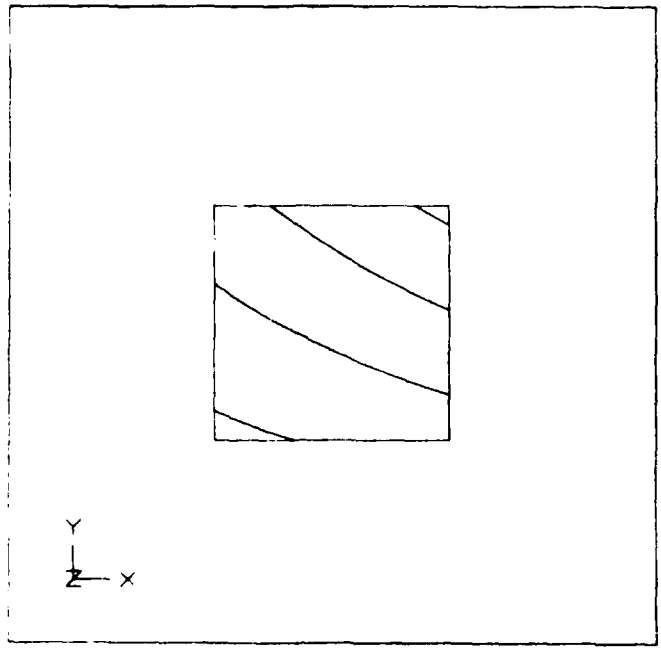

Figure 5 - Front of Cube with Contour Lines

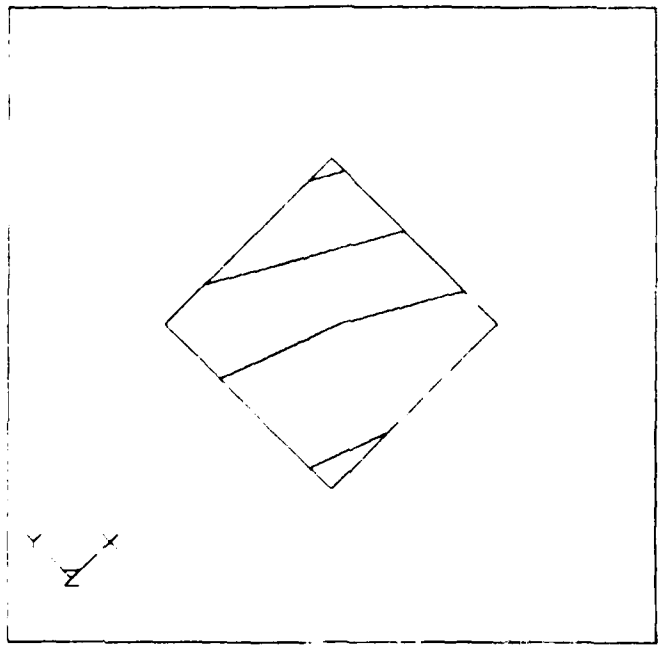

Figure 6 - Front of Cube with Contour Lines, Rotated 45 Degrees

FEATURE

Figure 7 shows part of a projectile housing drawn with the VIEW command. Figure 8 shows the same object drawn with a feature angle of one degree. The FEATURE command has eliminated any line segments on a flat surface. However, some horizontal line segments were also eliminated as explained in Reference 2 (Appendix A, page 2-12).

FLAT

Flat element shading is the default shading algorithm used for color images. Frames 6 and 54 are examples of flat element shading.

FRINGE

The number of color fringes cannot exceed eleven. The location and color of the color fringes depend highly on the number of color fringes specified, the range of the displacement or scalar function on that object, and the range of the function that will have fringes.

Frames 33, 34, and 38 show a cube with incorrect specifications for the number and range of color fringes. Frames 35, 36, and 37 do make some sense, but the fringes are not continuous around the corners of the cube. Again, incorrect values for the number and range of color fringes were specified.

LIGHT

Typical lighting model parameter values of the regular light exponent, the highlight intensity, and the highlight exponent are (1, 1, 6) respectively. Figure 4 and Frame 17 show examples of these values. Decreasing the highlight intensity decreases the amount of white as shown in Frames 18 and 19. Increasing the highlight exponent decreases the size of the white area as shown in Frame 20. Increasing the regular light exponent increases the amount of black as shown in Frame 21.

All the Frames in the photo album were generated with the light source at the eye of the observer except for Frame 50. In Frame 50 the light source is to the right of the observer.

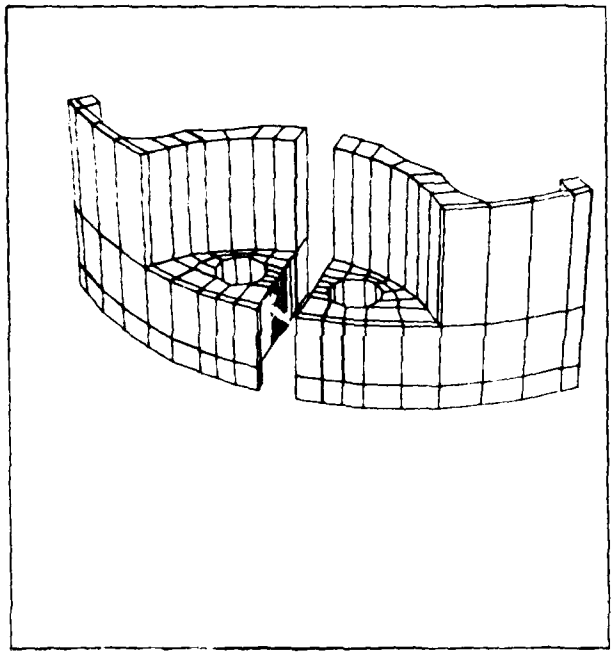

Figure 7 - Part of Projectile Housing, Line Drawing

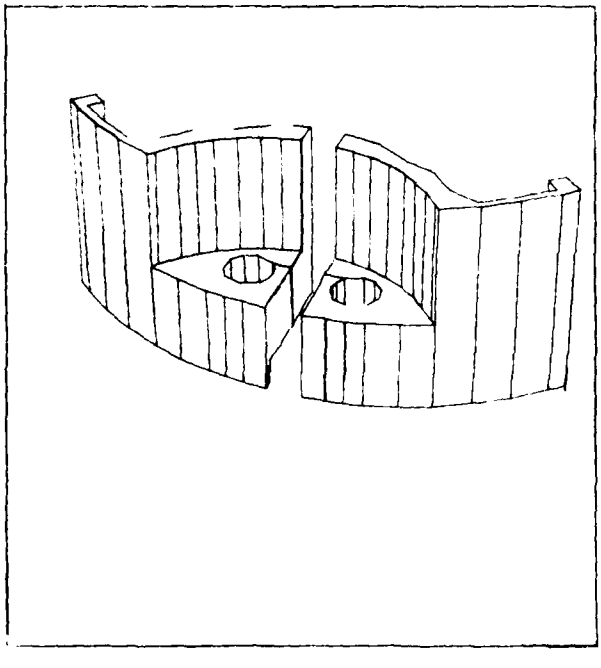

Figure 8 - Part of Projectile Housing,
Feature Angle of One Degree

NODE

Figure 9 shows an exploded sphere drawn with node numbering enabled.

POLYGON

Figure 10 shows an exploded sphere with polygon numbering enabled.

RECORD

The RECORD command cannot be used as the first command or within the first line of a string of commands. It can be used anytime after the first command or first line of commands has been executed.

SCOPE

The only valid responses to the prompt <DEVICE> are TEKT and TK27. This also applies when using the DEVICE command.

Decreasing the visible segment computation resolution for the Watkin's hidden line algorithm will reduce the computation time when the VIEW command is used. However, the resulting picture may be distorted. Figure 11 shows an object drawn with a computation resolution of 1024 (default value). Figure 12 shows the same object drawn with a computation resolution of 256. Figure 13 shows the same object drawn twice, once with the VIEW command and once with the DRAW command. Some of the line segments are offset from each other. The DRAW command essentially draws with an infinite computation resolution because the hidden line algorithm is not used. Therefore, when the VIEW command is used, the line segments may not be drawn in their actual locations.

SMOOTH

Figure 4 and Frames 4, 5, 16, 23, 31, 40, 45, and 46 are examples of objects drawn with smooth element sheding. Frame 16 shows the effect of the number of elements used for a curved surface on the smooth shading algorthm. As the number of elements used for a surface increases, the smoothing looks more realistic. Frame 60 is an example of an effort to smooth around sharp edges.

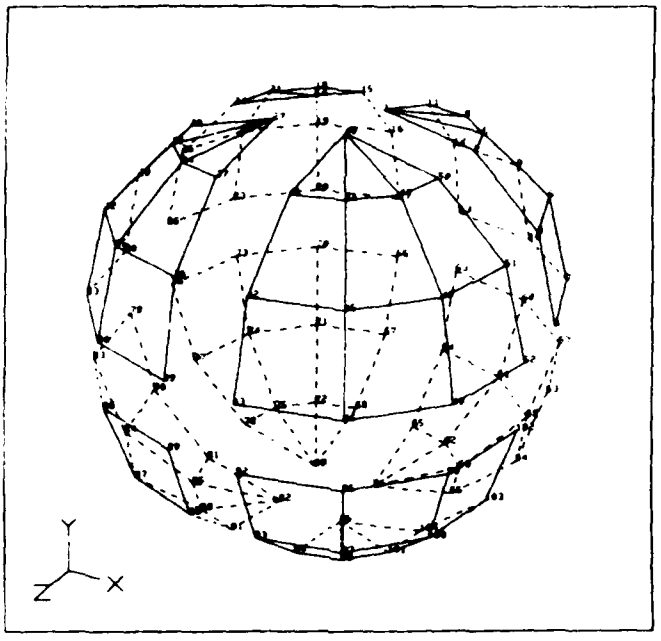

Figure 9 - Example of Node Numbering

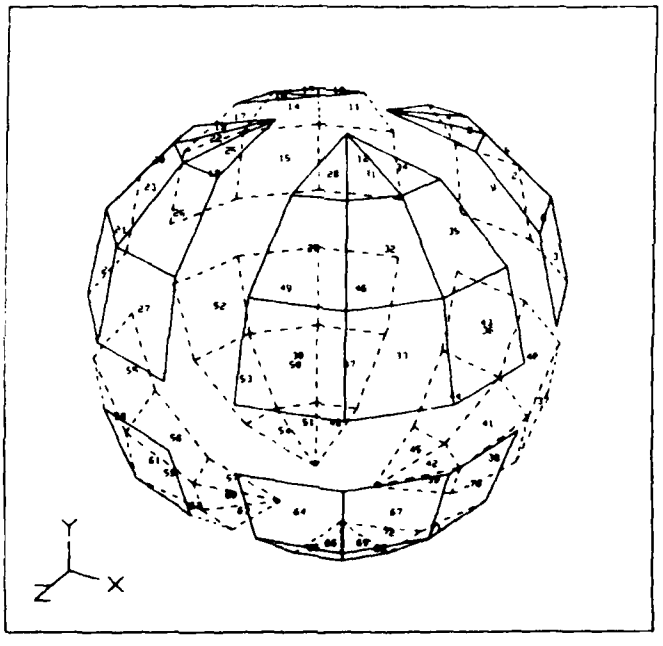

Figure 10 - Example of Polygon Numbering

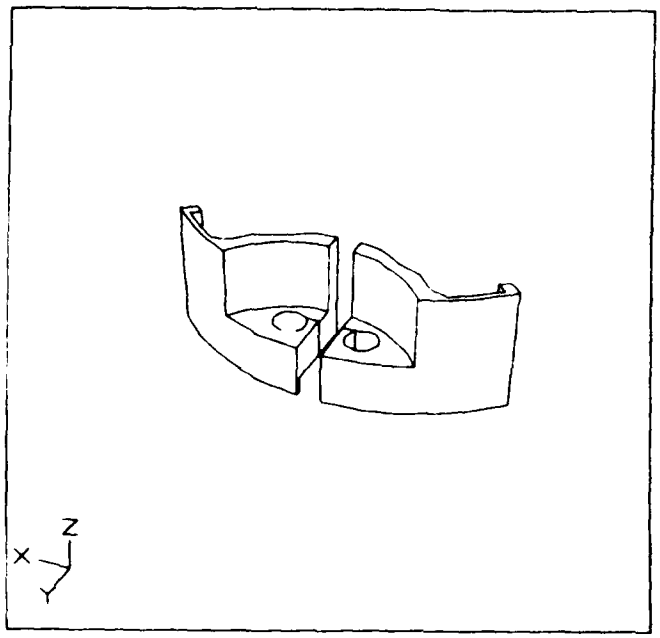

Figure 11 - Object Drawn with Computation Resolution of 1024

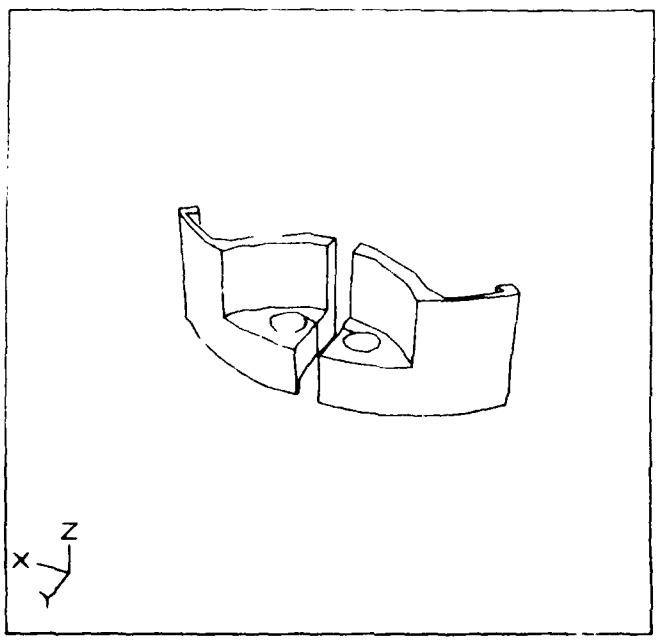

Figure 12 - Object Drawn with Computation Resolution of 256

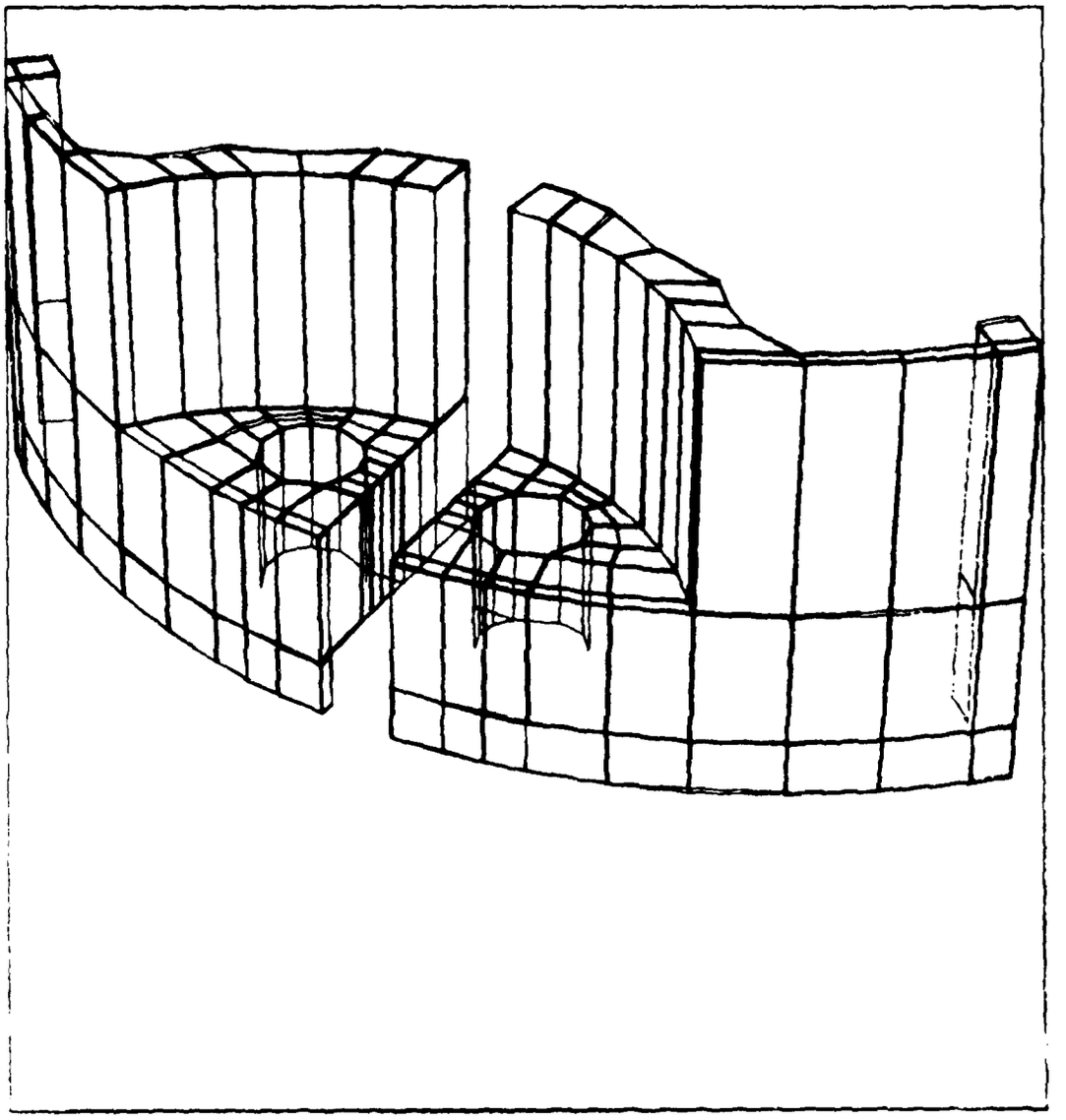

Figure 13 - Object Drawn Twice with VIEW and DRAW Commands

UNIFORM

Frames 1, 2, 3, 7, 14, 15, 42, 57, 58, 63, and 64 are examples of uniform element shading. Comparison of Frames 7, 14, and 15 shows the effect of the color order and the number of elements on uniform element shading.

VIEW

Figure 14 shows an example of an object drawn with the VIEW command. Figure 15 shows the same object drawn with the DRAW command. The same object in color is shown in Frames 63 and Figure 4.

The VIEW command will not work properly with objects that have extremely warped elements. Figure 16 and Frames 42, 43, and 44 show a distorted mobius strip. An undistorted mobius strip, drawn with the VIEW command, is shown in Figure 17.

UTILITY

Sometimes the error message <ERROR: ATTEMPT TO EXCEED NJMAX OR NPTMAX OF XXXXX!> will be printed when, in fact, these quantities have not been exceeded. UTILITY estimates NJMAX and NPTMAX before their actual values are computed and prints error messages based on the estimates.

SECTION AND BECTION

The polyhedral geometry editor within SECTION has been eliminated to reduce the size of SECTION to fit into 110K words of computer storage. This change eliminates the <EDIT?> prompt after a geometry file has been read. The first question in SECTION is now <ENTER FIELD LENGTH, 65 or 110>. SECTION will ask <WRITE INTE FILE> instead of <WRITE INTERMEDIATE FILE>. The capability for inputing twenty-noded brick elements in the general polyhedal format does not exist in either program, contrary to what is stated in the SECTION User's Manual.

COMPOSE

Whenever an alphanumeric message should be printed after the terminal screen is cleared, not all of the message will be printed.

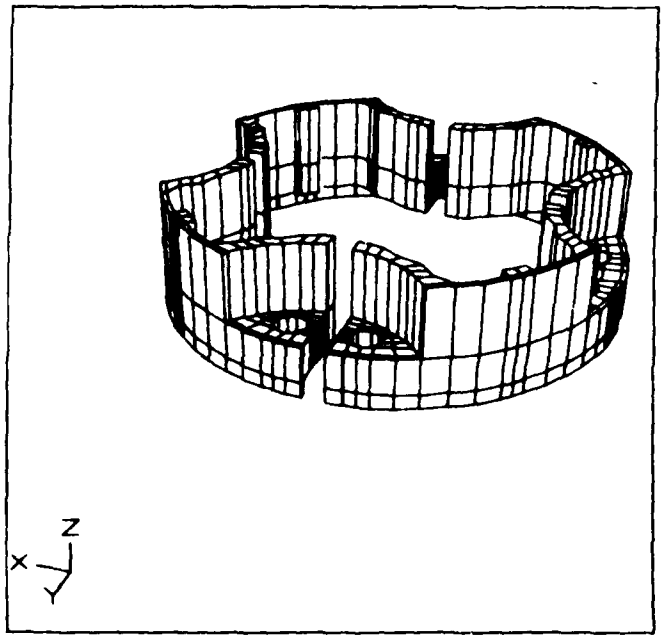

Figure 14 - Object Drawn with the VIEW Command

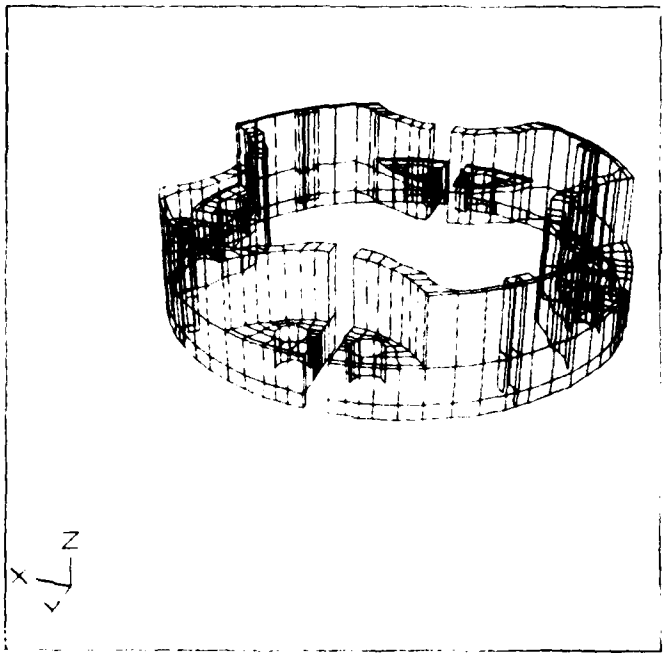

Figure 15 - Object Drawn with the DRAW Command

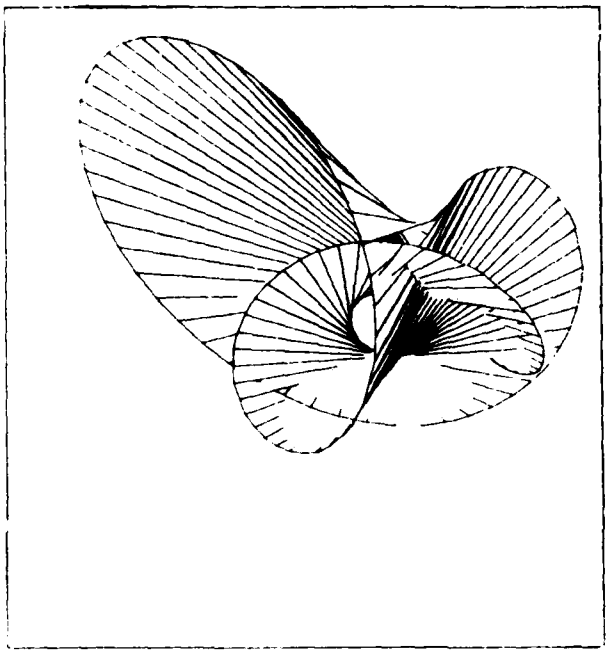

Figure 16 - Distorted Mobius Strip

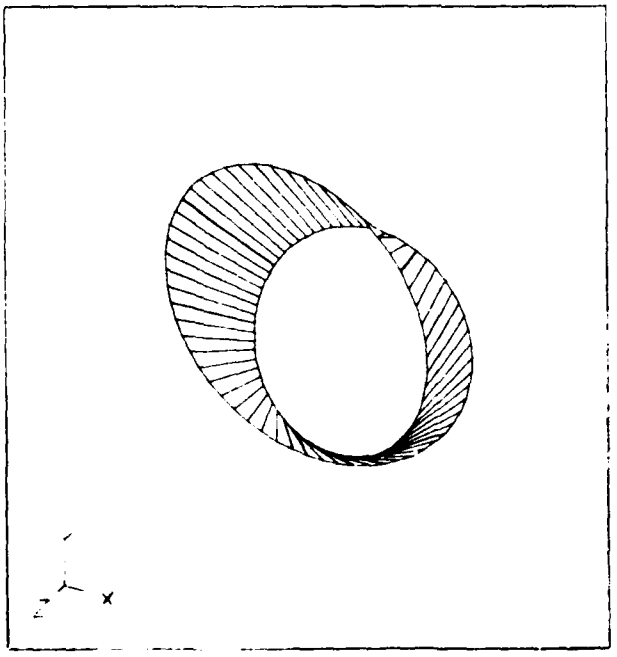

Figure 17 - Undistorted Mobius Strip

INTERFACING TO AND FROM THE MOVIE.BYU DATA FORMAT

The use of geometry, displacement, and scalar function files generated by another program (such as NASTRAN) as input to MOVIE.BYU requires that a conversion program be written. Such a program is also required when data from MOVIE.BYU will be used as input to another computer program, although this type of conversion is less likely to be needed because of MOVIE.BYU's limited data generating capabilities.

The main problem with the MOVIE.BYU data format is the lack of user specified node and element numbering. Therefore any node or element numbering will be lost when data are converted to the MOVIE.BYU data format. MOVIE.BYU has internal node and element numbering, increasing monotonically from one. The first set of X, Y, Z coordinates is node 1, the second set is node 2, and so on. Numbering of the elements is similar. When converting data to the MOVIE.BYU format, the user must keep track of the correspondence of old and new node and element numbers.

One program is available that will convert a NASTRAN bulk data deck into the MOVIE.BYU data format to preview the finite element mesh. The conversion program accepts only the following NASTRAN bulk data cards: GRID, CIHEX1, CIHEX2, CHEXA1, CHEXA2, CWEDGE, CQUAD1, CQUAD2, CQDMEM, CQDMEM1, CQDMEM2, CQDPLT, CIS2D8, CTRIA1, CTRIA2, CTRMEM, CTRPLT, CTRIM6, CTRPLT1, CTRSHL, CBAR, CROD, and PLOTEL. All other cards are ignored. The program assumes all coordinates are in a Cartesian coordinate system. A cylindrical coordinate system is also allowed if it is specified as coordinate system 2.

The conversion program will create two files: TAPE10 and TAPE11. TAPE10 is the file of polygonal elements and TAPE11 is the file of solid elements. The solid elements must be run through SECTION to convert them into polygonal elements. The resulting file from SECTION must be merged with TAPE10. This is done with the UTILITY program.

To automate the sequence of using the conversion program with SECTION and UTILITY, a procedure is available that integrates the use of all three programs. The input to the procedure is the NASTRAN bulk data deck and the output is a file, in the correct MOVIE.BYU data format, that can be displayed with MOVIE.

To run the conversion procedure interactively, enter the following commands at any terminal:

```
FETCH,MBYU,CARL
MBYU,input,output,XXXX,account,password
```

where

input	=	permanent file name of the NASTRAN bulk data deck
output	=	permanent file name of the resulting MOVIE.BYU-readable file
XXXX	=	user's computer ID
account	=	user's computer access number
password	=	MSS password

The procedure will submit a batch job that will run the conversion program, SECTION and UTILITY. The resulting MOVIE.BYU-readable file will be cataloged as a permanent file with the name output.

CONCLUSION

The installation of MOVIE.BYU is a first step in color graphics at DTNSRDC. MOVIE.BYU has performed generally as expected, given the existing computer hardware. Future improvements to the computer hardware should include faster communication rate between the terminal and the computer, acquisition of a hard copy unit (black and white or color), and a high quality color monitor with a frame buffer. The improvements should make MOVIE.BYU a more useful, day-to-day tool.

ACKNOWLEDGMENTS

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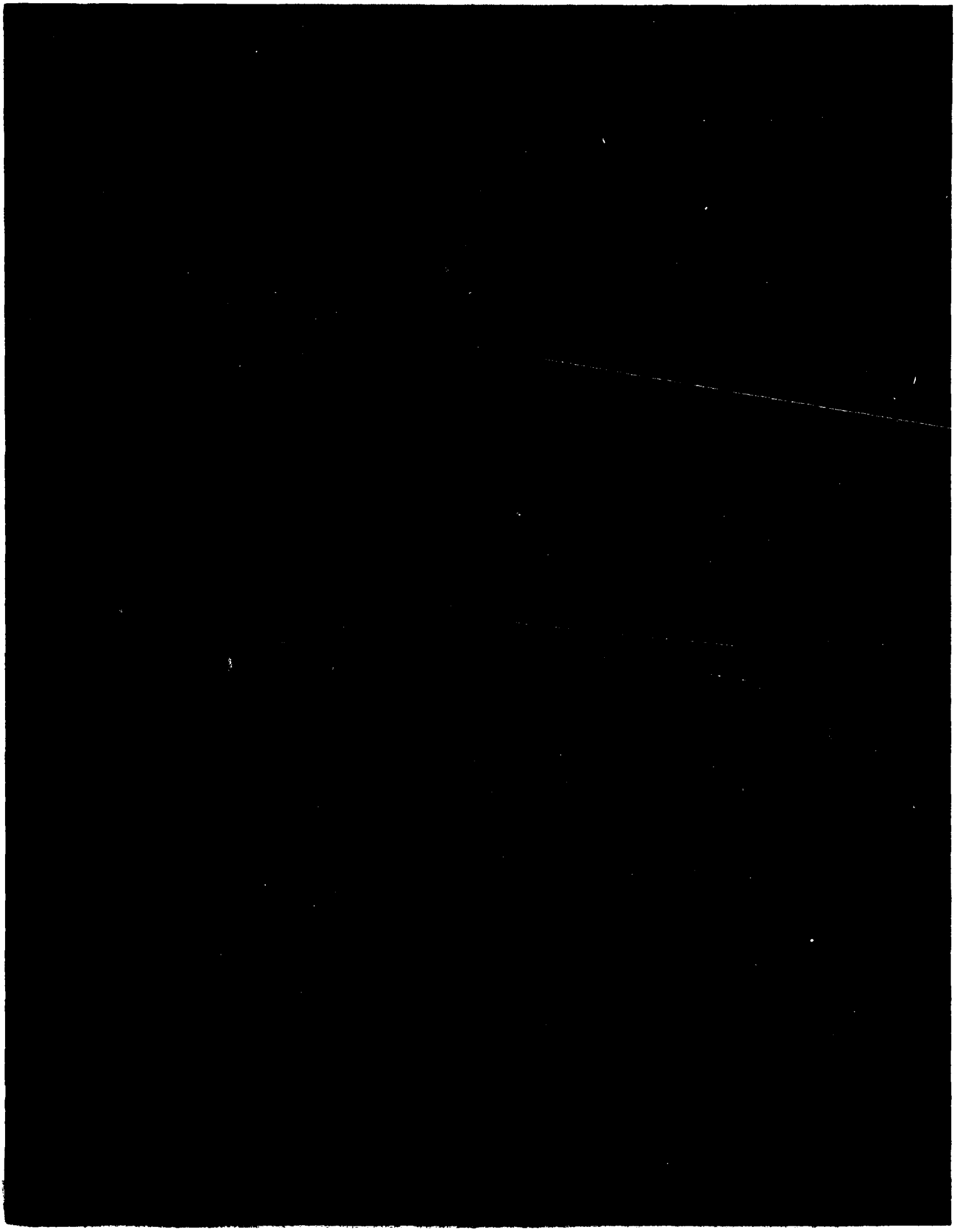

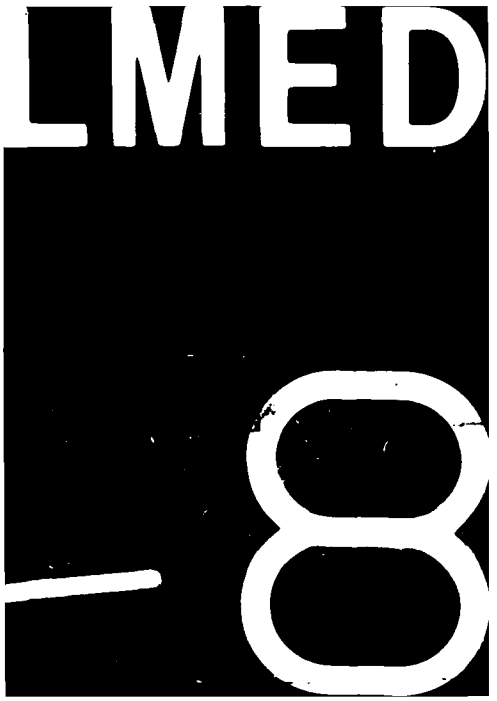
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8